

1201.64722



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE


Applicant: Li et al.)
Serial No.: 09/662,682)
Conf. No.: 1914)
Filed: September 15, 2000)
For: METAL-ASSISTED)
CHEMICAL ETCH POROUS)
SILICON FORMATION)
METHOD)
Art Unit: 1765)
Examiner: Vinh, Lan)

I hereby certify that this paper is being deposited with the United States Postal Service as FIRST-CLASS mail in an envelope addressed to: Mail Stop Non Fee Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this date.

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Date
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Appr. February 20, 1998


Registration No. 35182

Attorney for Applicant

RESPONSE A

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MAIL STOP NON FEE AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action mailed July 8, 2003, please consider the following remarks.

REMARKS

The previous rejections have been withdrawn. Another non-final Office Action has been issued. Claim 1-21 are pending in the application and stand rejected. The rejections are respectfully traversed.

Claims 1-2, 4-5, 10-12, 14-15 and 21 stand rejected under § 102 as being anticipated by Lee, U.S. Patent 5,565,084. This rejection is traversed.

The method disclosed in Lee is so different from that which is claimed that pointing out the differences between Lee and the claims involves every element of the claims and pointing this out should not be taken to limit the scope of any term in the claim, but only

to show that the interpretation of the reference was misguided. Applicants will limit the remarks to the § 102 rejection of Lee as this is more than a sufficient traversal of all of the outstanding rejections in the Office Action.

The first line of the statement of the rejection on page 2 is sufficient to show why this rejection should not have been made. The Examiner states that “Lee discloses an electropolishing method for etching substrate.” This may also be garnered from the abstract where Lee states that “the substrate is made to be porous by flowing a constant current and etched by the action of the etchant solution while breaking the current.”

As described in column 4, lines 35 through 47, electrical current forms an important part of the process in Lee. The main point of Lee’s process is that a boron-doped area provides a pathway that enhances the hole formation. Having recognized the use of electrical current in Lee, it is not possible to make a proper rejection of the present claims. Claim 1 requires the etching to be conducted “without external electrical bias”. The same limitation is found in claim 11. The same limitation is found in claim 21. Since Lee uses external electrical bias, namely the constant current source 25, Lee does not meet this claim limitation.

The Examiner repeatedly states that Lee’s porous silicon formation is conducted without electrical bias, but this is also starkly contradicted by the reference. Apparently, the Examiner assumes that because current is broken for a short period, that it is proper to say that the formation of the porous silicon is without electrical bias. However, the electrical bias is clearly necessary to the formation of the porous silicon in the Lee reference.

Lee states unequivocally:

“Fig. 3B shows a porous silicon layer 31 which is made irrespective of the position in the silicon substrate by application of a constant current to the electropolishing system of Fig. 2. Thereafter, the supply of the constant current is broken and then, the etchant solution works to etch the porous silicon layer 31, as shown in Fig. 3C.”

In the absence of the electropolishing current, Lee discloses no method for the formation of porous silicon. The electropolishing current is required for Lee’s formation process.

A next point concerns the Examiner's determination that Lee has a discontinuous layer, identifying the layer as 1,000 angstroms thick. This is not a discontinuous layer, and nowhere does Lee state that it is a discontinuous layer. Layers of metal become continuous well before 1,000 angstroms. Consistent with this principle, the layer 15 in Lee is illustrated and treated as a standard semiconductor layer having a shape and thickness similar to other layers in the device. There is absolutely no basis from the Lee reference to conclude that layer 15 is discontinuous in any form. The fact that it is continuous is unequivocally stated by Lee. In column 3 at line 66 and 67, Lee defines a 1,000 to 2,000 angstrom thick gold or platinum layer that is "deposited over the entire surfaces of the resulting structure, followed by formation of a blanket sacrificial layer 16 on the metal layer 15." If the Examiner was arbitrarily labeling a 1,000 to 2,000 angstrom thick layer as being discontinuous, this is inappropriate. However, Lee also explicitly makes clear that it is continuous layer because it is "deposited over the entire surfaces of the resulting structure."

Nor does the Office Action make a correct conclusion in determining that the metal layer 15 assists in the formation of a porous layer in the Lee reference. Lee is primarily concerned with the formation of a suspended metal membrane, as seen in Fig. 1F. Beginning with Fig. 1D, a metal layer 15 is at least 1,000 angstroms thick, which also is not a discontinuous layer as discussed above. The etching process is shown in Figs. 1D-1F, and it is an etching process that occurs on an opposite side of the layer structure away from the layer 15, namely from the backside of the silicon substrate 11. In Fig. 1F, a layer 16 is a sacrificial layer that is only removed after the backside substrate 11 is etched to produce a hole 17 shown in Fig. 1F. Figs. 3A-3B also disclose a porous silicon formation 31, but this again occurs on the backside of the substrate well away from the relatively thick metal layer 15.

As indicated previously, Applicants will not address the remaining rejections individually as they inherit the defects of the § 102 rejection based upon Lee. Applicants maintain the separate patentability of all the claims.

For the foregoing reasons, Applicants request reconsideration and allowance of the instant application. The Examiner should call Applicant's attorney if an interview would expedite prosecution.

Respectfully submitted,

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By



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October 7, 2003

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